TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74HC373AP,TC74HC373AF,TC74HC373AFW

## Octal D-Type Latch with 3-State Output

Note: xxxFW (JEDEC SOP) is not available in Japan.

The TC74HC373A is a high speed CMOS OCTAL LATCH with 3-STATE OUTPUT fabricated with silicon gate $C^2MOS$ technology.

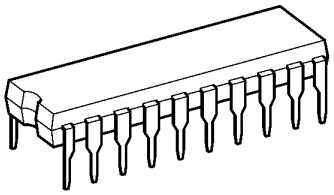
It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

These 8-bit D-type latches are controlled by a latch enable input (LE) and a output enable input ($\overline{OE}$).

When the $\overline{OE}$ input is high, the eight outputs are in a high impedance state.

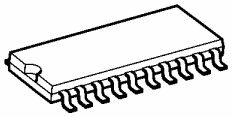
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

TC74HC373AP

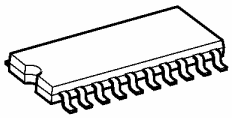


DIP20-P-300-2.54A

TC74HC373AF

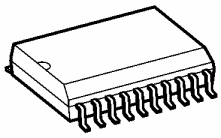


SOP20-P-300-1.27A



SOP20-P-300-1.27

TC74HC373AFW

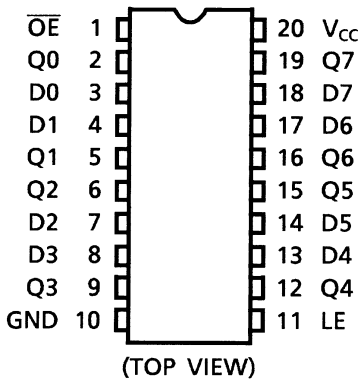


SOL20-P-300-1.27

## Features

- High speed: $t_{pd}$ = 11 ns (typ.) at $V_{CC}$ = 5 V
- Low power dissipation: $I_{CC}$ = 4 μA (max) at Ta = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% $V_{CC}$ (min)
- Output drive capability: 15 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL}$ = 6 mA (min)
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: $V_{CC}$ (opr) = 2 to 6 V
- Pin and function compatible with 74LS373

## Pin Assignment

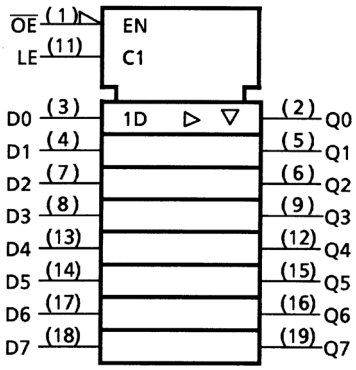



(TOP VIEW)

Weight

| | |
|---|---|
| DIP20-P-300-2.54A | : 1.30 g (typ.) |
| SOP20-P-300-1.27A | : 0.22 g (typ.) |
| SOP20-P-300-1.27 | : 0.22 g (typ.) |
| SOL20-P-300-1.27 | : 0.46 g (typ.) |

## IEC Logic Symbol




## Truth Table

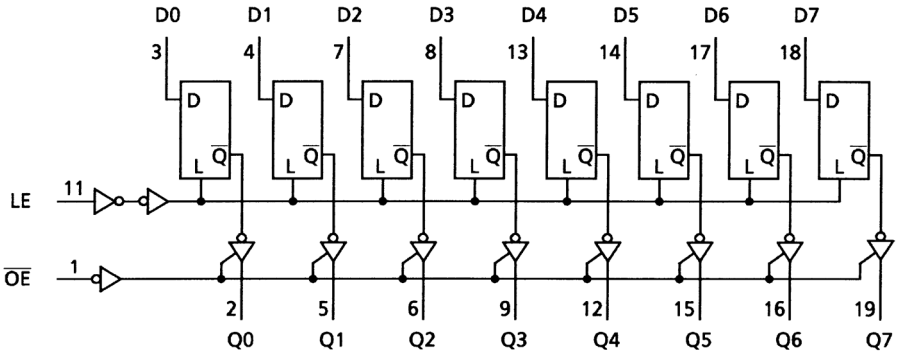
| Inputs | | | Output |
|---|---|---|---|
| $\overline{OE}$ | LE | D | Q |
| H | X | X | Z |
| L | L | X | $Q_n$ |
| L | H | L | L |
| L | H | H | H |

X: Don't care

Z: High impedance

$Q_n$: Q outputs are latched at the time when the LE input is taken to a low logic level.

## System Diagram



## Absolute Maximum Ratings (Note 1)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage range | $V_{CC}$ | −0.5 to 7 | V |
| DC input voltage | $V_{IN}$ | −0.5 to $V_{CC}$ + 0.5 | V |
| DC output voltage | $V_{OUT}$ | −0.5 to $V_{CC}$ + 0.5 | V |
| Input diode current | $I_{IK}$ | ±20 | mA |
| Output diode current | $I_{OK}$ | ±20 | mA |
| DC output current | $I_{OUT}$ | ±35 | mA |
| DC $V_{CC}$/ground current | $I_{CC}$ | ±75 | mA |
| Power dissipation | $P_D$ | 500 (DIP) (Note 2)/180 (SOP) | mW |
| Storage temperature | $T_{stg}$ | −65 to 150 | °C |

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Note 2: 500 mW in the range of Ta = −40 to 65°C. From Ta = 65 to 85°C a derating factor of −10 mW/°C shall be applied until 300 mW.

## Recommended Operating Conditions (Note)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | 2 to 6 | V |
| Input voltage | $V_{IN}$ | 0 to $V_{CC}$ | V |
| Output voltage | $V_{OUT}$ | 0 to $V_{CC}$ | V |
| Operating temperature | $T_{opr}$ | −40 to 85 | °C |
| Input rise and fall time | $t_r$, $t_f$ | 0 to 1000 ($V_{CC}$ = 2.0 V)<br>0 to 500 ($V_{CC}$ = 4.5 V)<br>0 to 400 ($V_{CC}$ = 6.0 V) | ns |

Note: The recommended operating conditions are required to ensure the normal operation of the device. Unused inputs must be tied to either VCC or GND.

## Electrical Characteristics

### DC Characteristics

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Ta = 25°C Min | Ta = 25°C Typ. | Ta = 25°C Max | Ta = −40 to 85°C Min | Ta = −40 to 85°C Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| High-level input voltage | $V_{IH}$ | — | | 2.0 | 1.50 | — | — | 1.50 | — | V |
| | | | | 4.5 | 3.15 | — | — | 3.15 | — | |
| | | | | 6.0 | 4.20 | — | — | 4.20 | — | |
| Low-level input voltage | $V_{IL}$ | — | | 2.0 | — | — | 0.50 | — | 0.50 | V |
| | | | | 4.5 | — | — | 1.35 | — | 1.35 | |
| | | | | 6.0 | — | — | 1.80 | — | 1.80 | |
| High-level output voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −20 μA | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | |
| | | | $I_{OH}$ = −6 mA | 4.5 | 4.18 | 4.31 | — | 4.13 | — | |
| | | | $I_{OH}$ = −7.8 mA | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 μA | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | $I_{OL}$ = 6 mA | 4.5 | — | 0.17 | 0.26 | — | 0.33 | |
| | | | $I_{OL}$ = 7.8 mA | 6.0 | — | 0.18 | 0.26 | — | 0.33 | |
| 3-state output off-state current | $I_{OZ}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$<br>$V_{OUT}$ = $V_{CC}$ or GND | | 6.0 | — | — | ±0.5 | — | ±5.0 | μA |
| Input leakage current | $I_{IN}$ | $V_{IN}$ = $V_{CC}$ or GND | | 6.0 | — | — | ±0.1 | — | ±1.0 | μA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 6.0 | — | — | 4.0 | — | 40.0 | μA |

### Timing Requirements (input: $t_r = t_f = 6$ ns)

| Characteristics | Symbol | Test Condition | $V_{CC}$ (V) | Ta = 25°C Typ. | Ta = 25°C Limit | Ta = −40 to 85°C Limit | Unit |
|---|---|---|---|---|---|---|---|
| Minimum pulse width (LE) | $t_{W(H)}$ | — | 2.0 | — | 75 | 95 | ns |
| | | | 4.5 | — | 15 | 19 | |
| | | | 6.0 | — | 13 | 16 | |
| Minimum set-up time (Dn) | $t_s$ | — | 2.0 | — | 50 | 65 | ns |
| | | | 4.5 | — | 10 | 13 | |
| | | | 6.0 | — | 9 | 11 | |
| Minimum hold time (Dn) | $t_h$ | — | 2.0 | — | 5 | 5 | ns |
| | | | 4.5 | — | 5 | 5 | |
| | | | 6.0 | — | 5 | 5 | |

**AC Characteristics (input: $t_r = t_f = 6$ ns)**

| Characteristics | Symbol | Test Condition | | | Ta = 25°C | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CL (pF) | $V_{CC}$ (V) | Min | Typ. | Max | Min | Max | |
| Output transition time | $t_{TLH}$ $t_{THL}$ | — | 50 | 2.0 | — | 20 | 60 | — | 75 | ns |
| | | | | 4.5 | — | 6 | 12 | — | 15 | |
| | | | | 6.0 | — | 5 | 10 | — | 13 | |
| Propagation delay time (LE-Q) | $t_{pLH}$ $t_{pHL}$ | — | 50 | 2.0 | — | 42 | 125 | — | 155 | ns |
| | | | | 4.5 | — | 14 | 25 | — | 31 | |
| | | | | 6.0 | — | 12 | 21 | — | 26 | |
| | | | 150 | 2.0 | — | 57 | 175 | — | 220 | |
| | | | | 4.5 | — | 19 | 35 | — | 44 | |
| | | | | 6.0 | — | 16 | 30 | — | 37 | |
| Propagation delay time (D-Q) | $t_{pLH}$ $t_{pHL}$ | — | 50 | 2.0 | — | 42 | 125 | — | 155 | ns |
| | | | | 4.5 | — | 14 | 25 | — | 31 | |
| | | | | 6.0 | — | 12 | 21 | — | 26 | |
| | | | 150 | 2.0 | — | 57 | 175 | — | 220 | |
| | | | | 4.5 | — | 19 | 35 | — | 44 | |
| | | | | 6.0 | — | 16 | 30 | — | 37 | |
| Output enable time | $t_{pZL}$ $t_{pZH}$ | $R_L = 1$ kΩ | 50 | 2.0 | — | 39 | 125 | — | 155 | ns |
| | | | | 4.5 | — | 13 | 25 | — | 31 | |
| | | | | 6.0 | — | 11 | 21 | — | 26 | |
| | | | 150 | 2.0 | — | 54 | 175 | — | 220 | |
| | | | | 4.5 | — | 18 | 35 | — | 44 | |
| | | | | 6.0 | — | 15 | 30 | — | 37 | |
| Output disable time | $t_{pLZ}$ $t_{pHZ}$ | $R_L = 1$ kΩ | 50 | 2.0 | — | 30 | 125 | — | 155 | ns |
| | | | | 4.5 | — | 14 | 25 | — | 31 | |
| | | | | 6.0 | — | 13 | 21 | — | 26 | |
| Input capacitance | $C_{IN}$ | — | | | — | 5 | 10 | — | 10 | pF |
| Output capacitance | $C_{OUT}$ | — | | | — | 10 | — | — | — | pF |
| Power dissipation capacitance | $C_{PD}$ (Note) | — | | | — | 38 | — | — | — | pF |

Note: $C_{PD}$ is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

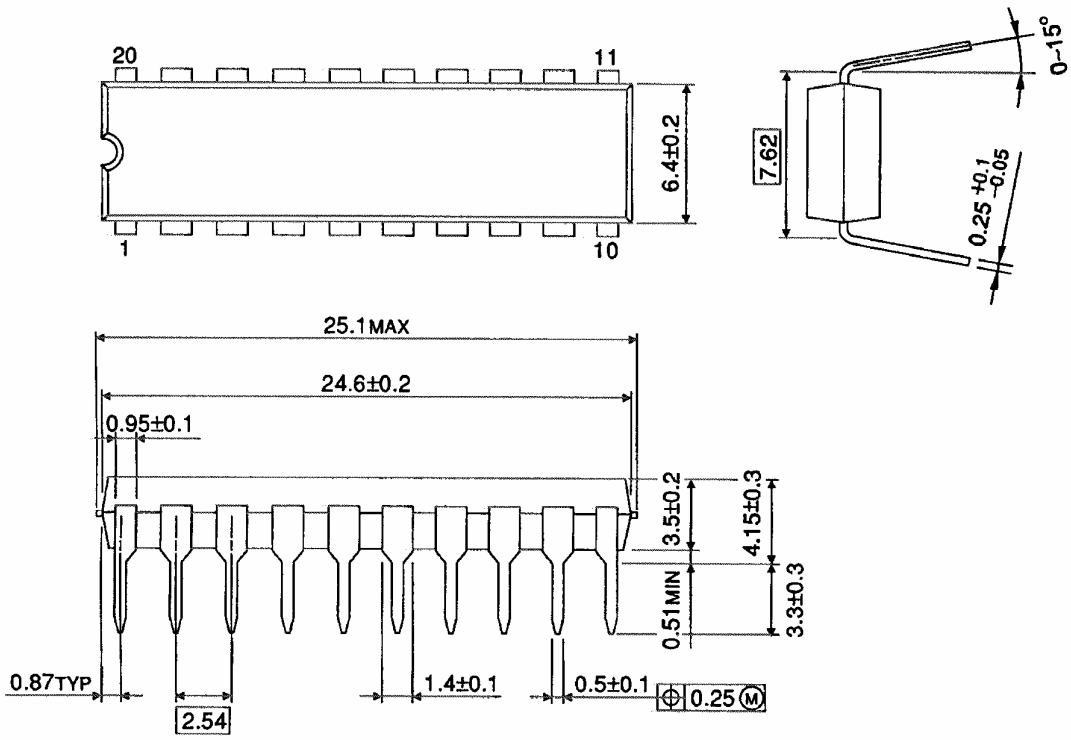
$$I_{CC}\ (opr) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8\ (\text{per latch})$$

And the total $C_{PD}$ when n pcs. of latch operate can be gained by the following equation:

$$C_{PD}\ (total) = 22 + 16 \cdot n$$

## Package Dimensions

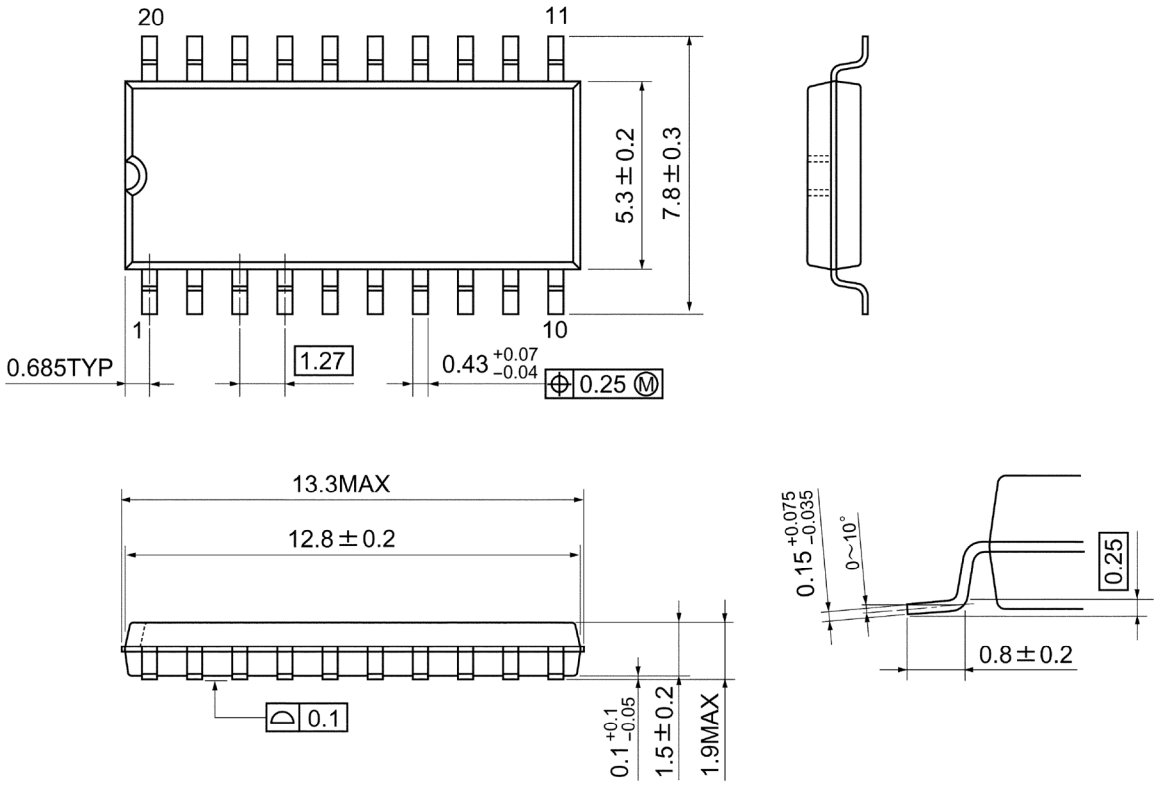
DIP20-P-300-2.54A Unit : mm




Weight: 1.30 g (typ.)

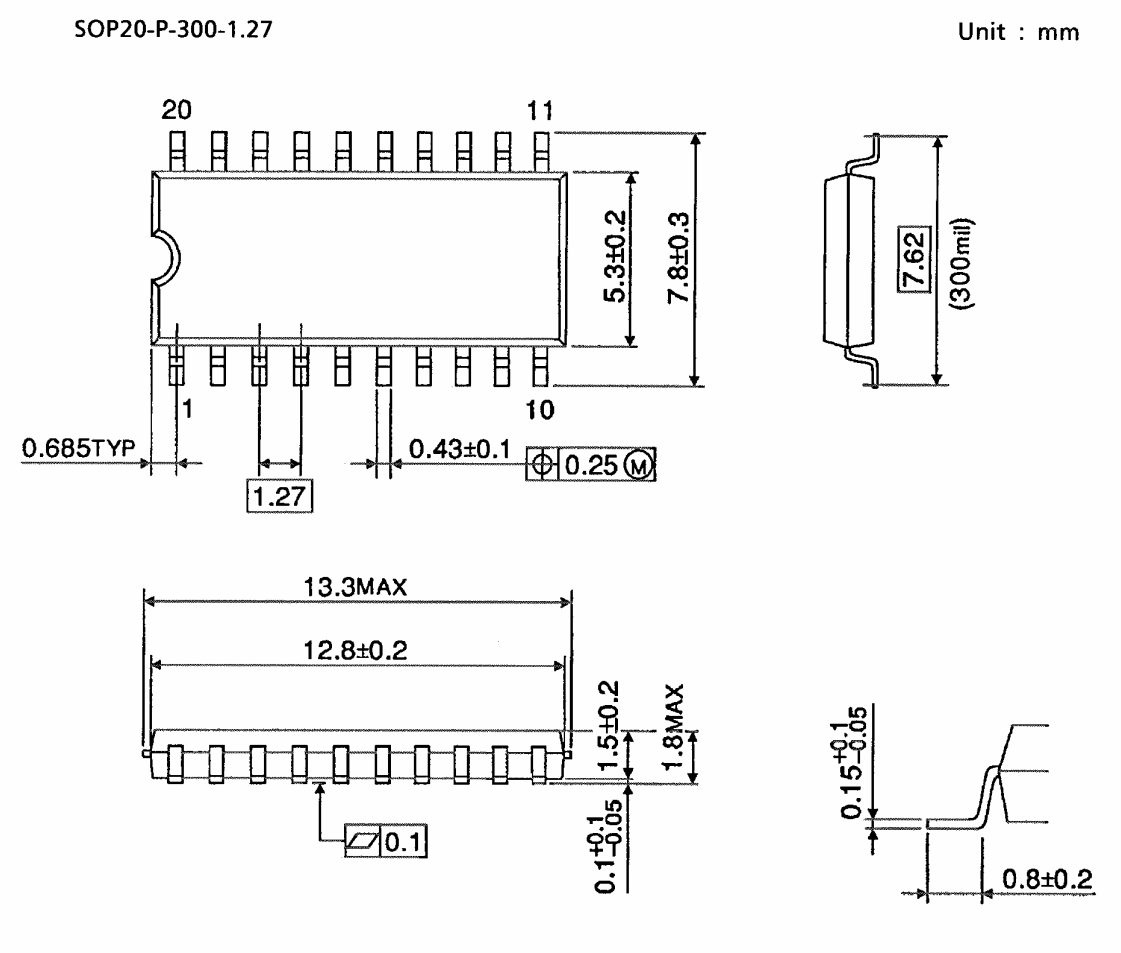
## Package Dimensions

SOP20-P-300-1.27A Unit: mm




Weight: 0.22 g (typ.)

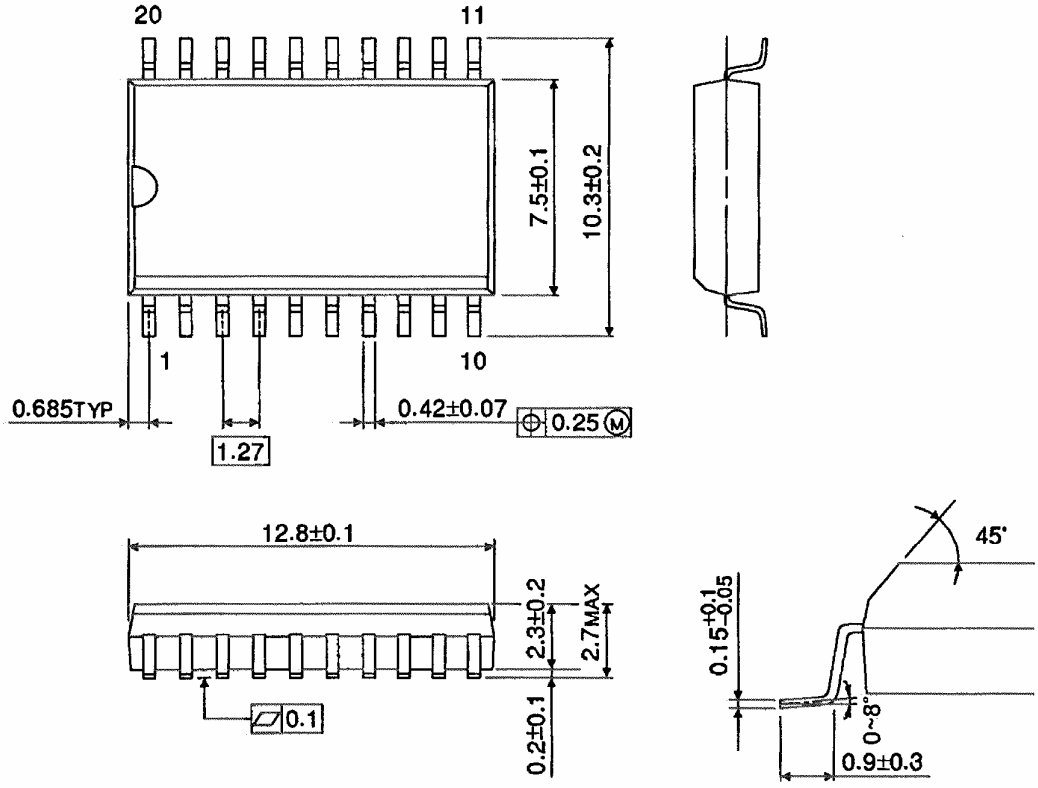
## Package Dimensions




Weight: 0.22 g (typ.)

## Package Dimensions (Note)

SOL20-P-300-1.27 Unit : mm




Note: This package is not available in Japan.

Weight: 0.46 g (typ.)

**Note: Lead (Pb)-Free Packages**

**DIP20-P-300-2.54A SOP20-P-300-1.27A**

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